

so-called gradation expression are possible.

[0007] However, as the pin drive system in the above-mentioned References 1 – 3, respective pins are not so designed to be arranged at narrow pitches, or fixed and held at a plurality of positions with regard to their axis direction. Also, in case of pattern display with a number of pins, and respective pins are driven by a driving device with the electromagnetic actuator, there is such a problem that the display speed is slow, as well as the motion noise is relatively loud.

Disclosure of the Invention

[0008] Referring to the above-mentioned problems, the object of the present invention is to offer a driving mechanism using shape memory alloys which can be assembled to a small size by simple composition, as well as a high speed motion is possible by especially easy integration, and further preferably, pins can be fixed and held at multi-steps, and various devices such as a display device equipped with the same, a write-in device equipped with the same, and the like.

[0009] The above-mentioned object will be attained, according to a first aspect of the present invention, by a driving mechanism using shape memory alloys comprising: a module wherein a first and a second shape memory alloy coils connected mutually in series in the axis direction, a drive member, and a fixing member are provided on one common substrate; a magnetic latch to hold the drive member; and a drive circuit to supply electricity to the first and the second shape memory alloy coils; said magnetic latch is made of a magnet plate and a plurality of magnetic bodies provided to said drive member; characterized in that said drive member is connected to the first and the second shape memory alloys coils and extending in the axis direction, the magnetic latch is made of a magnet plate and a plurality of magnetic bodies provided to the drive member, the first and the second shape memory alloy coils are selectively heated by electrical driving by the drive circuit, the drive member is moved in the axis direction by compressing or extending of the heated first or the second shape memory alloy coils, and the drive member is fixed and held in the axis direction by magnetically fixed to the magnetic

latch.

[0010] According to the above-mentioned aspect, in the driving mechanism using shape memory alloys, the drive member can be moved in the axis direction by compressing or extending by heating the first and the second shape memory alloys coils. When the drive

member is moved in the axis direction, it is fixed and held at the latch position in the axis direction by the magnetic latch. Therefore, the driving mechanism is composed from the shape memory alloys coils and the drive member merely by connecting each electrode of the shape memory alloys coil to the wire pattern of the drive circuit. Since the drive member is fixed and held at the moving position by the magnetic latch, each drive member is fixed and held without always turning on electricity to the shape memory alloys coil, thereby power consumption, and hence the running cost, are reduced. Since each drive member is fixed and held at the position of axis direction corresponding to the plurality of magnetic bodies, it is fixed and held at the multi-step position of axis direction, not at two steps of convex and concave positions like in conventional Braille display device.

[0011] The magnet plate of the magnetic latch is preferably provided with a penetration hole through which a drive member penetrates without contact, and said magnetic body is located apart mutually in the axis direction of the drive member, and the magnetic plate is magnetized in the axis direction of the drive member. Since the drive member is fixed and held at the corresponding latch position in the axis direction, and the magnetic plate is magnetized in the axis direction of the drive member, even if a plurality of drive members are inserted through penetration holes of one magnetic plate, the same magnetization state can be obtained at each penetration hole.

[0012] Therefore, in case of a plurality of driving mechanisms arranged in line, magnets are not needed between respective drive members, and hence simple configuration is possible. Thereby, respective driving mechanisms can be arranged at narrow pitch, and the smaller size can be designed as a whole. Since the magnetic plates constituting magnetic latches are separated from a substrate, each substrate is arranged vertically for combining a plurality of substrates, and a magnetic plate may be put thereon, so that the assembly and the decomposition are easy resulting in the improved maintenance.

[0013] A driving mechanism using shape memory alloys of the